REMARKS

Claims 1-5, 7, 9-19 and 21 are in this application and are presented for consideration. By this amendment, Applicant has amended claims 1, 9, 11 and 19. Specifically, claim 1 has been revised to include the features of claim 8 and claim 20 has been amended to include the features of claim 20. Accordingly, claims 8 and 20 have been canceled. It is Applicant's position that the changes to the claim do not raise any new issues as the features of claims 8 and 20 have already been considered in the previous Office Action.

Applicant wishes to thank the Examiner for speaking with one of Applicant's representatives on December 11, 2008. During the discussion with the Examiner, Applicant's representative argued that Farley et al. does not disclose a bridge that receives torque and a forge force such that the torque and the forge force are not transmitted to a spindle as claimed. In response, Examiner stated that the actuator block 40 and the backup plate 52 do absorb the forces transmitted during friction welding. Applicant's representative stated that although actuator block 40 and backup plate 52 may absorb some of the forces produced during welding, forces are still transmitted to the spindle via chuck body 31. The Examiner suggested that the specific structure of the bridge be further clarified in the claims.

Claims 1-5, 7-11 and 13-21 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Takagi et al. (U.S. 3,954,215) in view of Farley et al. (U.S. 3,542,383).

The present invention relates to a friction welding machine that comprises a first headstock and a second headstock. The first headstock has a first spindle with a first workpiece

holder and a spindle drive. The friction welding machine includes a feed drive with a second workpiece holder. The second headstock is connected to the feed drive. The second headstock with a second spindle, another spindle drive and the second workpiece holder is mounted for movement on a frame such that the second headstock is movable in an axial direction. At least one of the first workpiece holder and the second workpiece holder has a bridge. The bridge advantageously relieves one of the first spindle and the second spindle of the torque and the forge force that are created during friction welding. This advantageously increases the service life of at least one of the spindles since the spindle is not subjected to the intense forces produced by the friction welding. The bridge also allows for the spindles to be rotated in opposite directions so that the speed of rotation acting at the site of friction can be significantly greater than that of conventional techniques. The prior art as a whole fails to disclose such features or such advantages.

The Office Action admits that Takagi fails to disclose at least one of the workpiece holders having a bridge as claimed and relies on Farley et al. to teach at least one workpiece holder having a bridge such that one of the workpieces does not receive a forge force and a torque produced by friction welding.

Farley et al. discloses a chuck assembly 12 that includes a chuck body 31 that is secured by capscrews 32 to a spindle nose 33 which is mounted upon a spindle 17 by capscrews 35. A drive key 34 is secured to the spindle nose 33 and interlocks with the chuck body 31 to insure rotation of the chuck assembly with the spindle. The chuck assembly includes an outer chuck 36 and an inner chuck 37 which are supported within the chuck body 31 in spaced apart

concentric relation to receive a workpiece WP-1. In operation during a weld cycle, the workpiece WP-1 is inserted into the chuck assembly between the outer chuck 36 and the inner chuck 37. A chucking cylinder rod 51 is retracted. The mandrel 44 is accordingly urged further into the chuck assembly by an actuator bolt 46 and causes expansion of the inner chuck sleeve 37. During this operation, the spring 59 is compressed between the mandrel 44 and the washer 61 as it comes in contact with the inner chuck 37. As the inner chuck sleeve 37 makes contact with the workpiece WP-1, axial force applied by the clamping cylinder is transferred through the inner sleeve to the actuator block 40. The actuator block is then also moved leftwardly and draws the outer chuck sleeve 36 further into the chuck body 31. Interaction of tapered surface 38 and 39 causes the outer chuck sleeve 36 to be restricted or collapsed upon the workpiece WP-1 so that the workpiece is secured in place during the entire welding operation by a constant force applied through the chucking cylinder. As the workpieces WP-1 and WP-2 are brought into axial engagement during the welding portion of the cycle, the workpiece WP-1 and the chuck assembly 12 are rotating together with the spindle 17. Axial thrust applied by the workpiece WP-2 against the workpiece WP-1 is transferred to the backup plate 52 and then into the actuator block 40. Since the outer chuck sleeve 36 is secured to the actuator block 40, additional force is applied collapses the outer sleeve 36 upon the workpiece and exerts still greater clamping force upon the workpiece WP-1.

Farley et al. fails to teach and fails to suggest the combination of at least one workpiece holder having a bridge wherein the bridge receives a torque and a forge force during friction welding such that at least one of a first spindle and a second spindle does not receive the forge

force and the torque produced via the friction welding. The Office Action takes the position that the backup plate 52 and the actuator block 40 of Farley et al. absorb the torque and the upsetting force during friction welding. Applicant respectfully disagrees with this interpretation of Farley et al. Farley et al. discloses a chuck assembly 12 that is connected to a spindle 17, which is driven, and a tailstock chuck 13 that is non-rotatable. Farley et al. clearly discloses an arrangement with only one spindle 17 wherein the spindle 17 would inevitably absorb the torques that occur during friction welding since there is no connection between the chuck assembly 12 and the housing of the friction welding machine 11 as shown in Figure 1. In fact, Column 2, lines 1-11 of Farley et al. disclose that the chuck assembly 12 has a chuck body 31, which is screwed to a spindle nose 33, and the spindle nose 33 is mounted on the spindle 17. As such, torque is transmitted to the spindle 17 of Farley et al. during welding by the chuck body 31 being connected to the spindle nose 33 via drive key 34. Compared with Farley et al., the bridge of at least one workpiece holder receives torque that is produced during friction welding such that at least one spindle does not receive the torque created from the welding. This significantly increases the service life of the spindle and advantageously allows the workpiece holders to be rotated in opposite directions so that the speed of rotation at the site of friction between the two workpieces is dramatically increased. Farley et al. fails to disclose such advantages since Farley et al. does not teach or suggest a bridge that receives torque such that the torque is not transmitted to at least one spindle during friction welding as claimed.

Farley et al. fails to provide any teaching or suggestion for the combination of a bridge that receives a forge force such that the forge force is not transmitted to at least one spindle

during friction welding. Farley et al. discloses that the workpiece WP-1 is held by an inner chuck 37 on the inside and by an outer chuck 36 on the outside such that the workpiece WP-1 is clamped between the inner chuck 37 and the outer chuck 36. The inner chuck 37 of Farley et al. is clamped by a mandrel 44 with the action of a chucking cylinder rod 51. However, the outer chuck 36 is additionally clamped during friction welding by the upsetting force introduced by the workpiece WP-1. Even though the workpiece WP-1 is supported at a backup plate 52 and acts on the actuator block 40, the chucking cylinder rod 51, the backup plate 52 and the actuator block 40 are pushed to the left by the upsetting force during friction welding. This disadvantageously transmits a force to the spindle 17 of Farley et al. and does not lead to a relief of the spindle 17 since the outer chuck 36 is supported via the keyway against the chuck body 31 so that upsetting forces act on the chuck body 31, which allows the forces to be transmitted to the spindle 17 since the chuck body 31 is fastened to the spindle 17. As such, a person of ordinary skill in the art would understand that the axial upsetting forces in Farley et al. would be transmitted to the spindle 17 since the chuck assembly 12 as a whole is fastened to the spindle 17 and has no other support such that the axial upsetting forces as well as the torques are absorbed by the spindle 17 and the spindle mount 18 only. Accordingly, Applicant respectfully requests that the Examiner reconsider the rejection and favorably consider claims 1, 19 and 21 as now presented and all claims that respectively depend thereon.

Favorable consideration on the merits is requested.

Respectfully submitted
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